इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 3055-1 (1994): Clinical thermometers, Part 1: solid stem type [MHD 12: Hospital Equipment]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

भारतीय मानक

डाक्टरी थर्मामीटर

भाग 1 ठोस डंडी प्रकार — विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

CLINICAL THERMOMETERS

PART 1 SOLID STEM TYPE — SPECIFICATION

(Second Revision)

First Reprint MAY 1999

UDC 563·512 : 616 — 073·65

© BIS 1994

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1994 Price Group 3

Medical Instruments and Disposables Sectional Committee, MHD 12

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Medical Instruments and Disposables Sectional Committee had been approved by the Medical Equipment and Hospital Planning Division Council.

This standard was first issued in 1965. In view of the adoption by the Government of India of 'Special schedule : Part II Clinical thermometers (new part)' of the Manual of Weights and Measures (Vol 1), based on the International Recommendation No. 7 'Clinical thermometers, mercury-in-glass with a maximum indicating device', issued by the International Organization for Legal Metrology (OIML), this standard was revised in 1977 to align it with the 'Special schedule' mentioned above.

Second revision of this standard has been undertaken to align it with the latest provisions of OIML No. 7 as well as EEC directives No. 76/764/EEC of 27 July 1976, on the approximation of the laws of the member states on clinical mercury-in-glass maximum reading thermometers. As a result of this alignment, the requirements for influence of immersion time and mean depression of zero have been added. The amendments No. 1 and 2 issued earlier as well as the requirements concerning aging and instructions for proper use have also been incorporated.

This standard (Part 1) covers the requirements and methods of sampling and tests for solid-stem type clinical thermometers. The enclosed-scale type thermometers are covered separately under Part II of this standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 MARCH 2002
TO
IS 3055 (Part 1) : 1994 CLINICAL THERMOMETERS
PART 1 SOLID STEM TYPE — SPECIFICATION

(Second Revision)

(*Second cover page, Foreword, para* 3) — Insert the following new para after para 3:

"The responsibility of 'first official verification' as mentioned under **8.2.2** and to mark 'a recognized mark of the verifying authority' as mentioned under **9.1** (e) shall be of officers authorized under the provision of the '*Standards of Weights and Measures (Enforcement) Act,* 1985'."

(*Page* 1, *clause* **5.1**) — Insert the following new clause after **5.1**:

'**5.2** In addition, the thermometers may also be graduated in degrees Fahrenheit (°F).'

(*Page* 3, *clause* **9.1**) — Insert the following new clause after **9.1** and renumber the subsequent clause:

'**9.1.1** Clinical thermometers with dual scale (i.e. Celcius and Fahrenheit) shall be legibly and indelibly marked on its stem with the letters °C and °F near the top of the relevant scale.'

(MHD 12)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 APRIL 2002
TO
IS 3055 (Part 1) : 1994 CLINICAL THERMOMETERS
PART 1 SOLID STEM TYPE — SPECIFICATION

(Second Revision)

(*Page* 3, *clause* **8.2.2**) — Substitute the following for the existing clause:

'**8.2.2** Clinical thermometers after ageing as per **8.2.1** shall ensure that their accuracy as measured by the method specified in Annex C, shall be as given below for at least one year after the first official verification:

Range °*C*	Accuracy °*C*
Less than 35.8	± 0.3
Greater than 35.8 but less than 37.0	± 0.2
37.0 to 39.0	± 0.1
Greater than 39.0 to 41.0	± 0.2
Greater than 41.0	± 0.3'

(MHD 12)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 OCTOBER 2004
TO
IS 3055 (PART 1) : 1994 CLINICAL THERMOMETERS
PART 1 SOLID STEM TYPE — SPECIFICATION

(Second Revision)

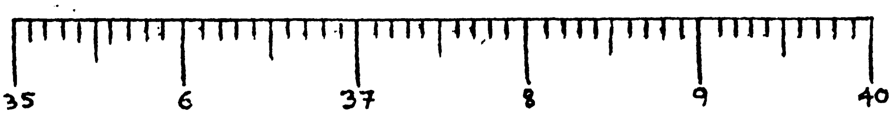
(*Page* 1, *clause* **2.1**) — Delete reference of IS 4825 : 1968.

(*Page* 1, *clause* **7.2.1**) — Insert the following at the end of the existing text:

"except for 'stability of bulb tube' and 'limit of alkanity'."

(*Page* 1, *clause* **7.2.3**) — Substitute '263.5 µg' *for* '263.5 g'.

(*Page* 2, *clause* **7.3.1.1**) — Substitute the following figure for the existing Fig. 1:



(*Page* 2, *Table* 1):

a) For overall length at Sl No. (iii), substitute '100 to 120' *for* '100 to 115'.

b) For external diameter of stem at Sl No. (v) substitute '4 to 7' *for* 4 to 6'.

(*Page* 2, *clause* **7.5.3**) — Delete 'or 0.15 mm, whichever is less' from the existing text.

(*Page* 3, *clause* **7.5.6**) — Substitute the following for the existing:

'**7.5.6** The numbers shall be placed suitably as shown in Fig. 1.'

(*Page* 5, *Annex* C, *clause* **C-1.2**) — Substitute the following for the existing text:

'Calibrated reference thermometer shall have range of 35° to 43°C and least count 0.05°C.'

(CHD 35)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 NOVEMBER 2004
TO
IS 3055 (PART 1) : 1994 CLINICAL THERMOMETERS
PART 1 SOLID STEM TYPE — SPECIFICATION

(Second Revision)

(*Page* 1, *clause* **3.1**) — Substitute the following for the existing text:

'**3.1** For the purpose of this standard, in addition to the definitions given in IS 2627 : 1979, following definitions shall also apply.

3.1.1 *Flat Magnifying Lens* — Thermometer stem glass in which the numerals, graduations and lens lie on the same relative surface.

3.1.2 *Reflecting Stem* — Stem glass containing a coloured stripe along its length in a location that, when reflected on the mercury column, allows greater contrast and enables the column to appear tinted.

3.1.3 *Triangular Magnifying Lenses* — Thermometer stem glass in which the numerals and graduations lie on surfaces, that smoothly merge to form a lens.'

(*Page* 1, *clause* **7.2.1**, *read with Amendment No.* 3) — Add the following at the end of the text:

"The shape, that is, the cross section of the capillary tube shall be prismatic having a lens form as shown in Fig. 1.'

(*Page* 1, *clause* **7.3.1**) — Insert the following at the beginning of the existing text:

"Thermometer stems are classified as follows (*see* Fig. 1):

a) Flat magnifying lens,

b) Triangular reflecting magnifying lens, and

c) Triangular magnifying lens.'

(*Page* 2, *clause* **7.3.1.1**) — Substitute 'Fig. 2' *for* 'Fig. 1'.

(*Page* 2, *clause* **7.3.4**) — Substitute 'Fig. 3 '*for* 'Fig. 2'.

(*Page* 2, *Table* 1) — Inset the following after Sl No. (i) and renumber Sl No. (ii) as (iii):

'ii) Scale range, °F 94 to 108 or 94 to 110'

(*Page* 2, *Table* 1) — Insert the following after Sl No. (ii) and and renumber the subsequent Sl No.:

'iv) Smallest scale division, °F 0.2'

[*Page* 2, *Table* 1, *Sl No.* (iv)] — Substitute '40 to 75' *for* '40 to 65'.

[*Page* 2, *Table* 1, *Sl No.* (v)] — Substitute the following for the existing:

'*Thickness of stem* – No dimension of the cross section of flat magnifying stems shall be greater than 7.6 mm nor less that 3.6 mm. No dimension of the cross section of triangular stems shall be less than 3.6 mm.'

(*Page* 3, *clause* **7.5.5**) — Substitute 'Fig. 2' *for* 'Fig. 1'.

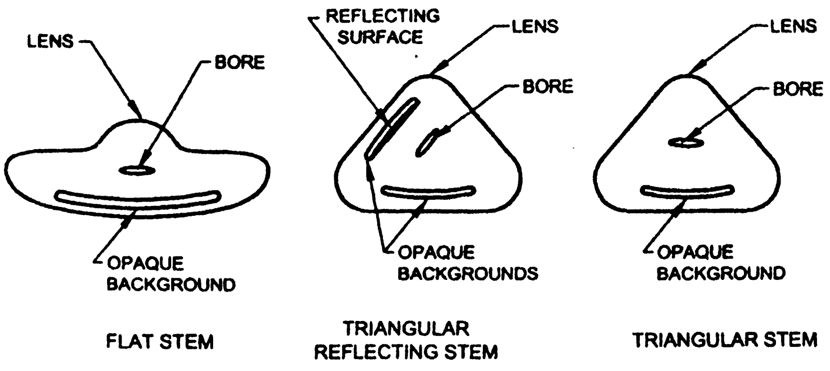


FIG. 1 CROSS SECTION OF MAGNIFYING LENS STEMS

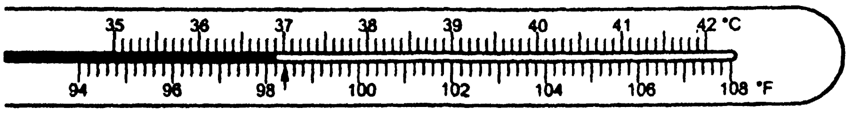


FIG. 2 STEM OF CLINICAL THERMOMETER

(CHD 35)

Reprography Unit, BIS, New Delhi, India

Indian Standard

CLINICAL THERMOMETERS

PART 1 SOLID STEM TYPE — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard (Part 1) specifies requirements and methods of sampling and tests for solid-stem, mercury-in-glass clinical thermometers having a maximum indicating device.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
2303 (Part 1/ Sec 1) : 1994	Method of grading glass for alkalinity: Part 1 Hydrolytic resistance, Section 1 Hydrolytic resistance of glass grains at 98°C – Method of test and classification (*first revision*)
2627 : 1979	Glossary of terms relating to liquid-in-glass thermometers (*first revision*)
4529 : 1968	Glass tubes for medical thermometers
4825 : 1968	Liquid-in-glass solid-stem reference thermometers (*first revision*)
6274 : 1971	Method of caliberating liquid-in-glass thermometers
8787 : 1977	Principles of design, construction and use of liquid-in-glass thermometers

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 2627 : 1979 shall apply.

4 TYPE

4.1 The thermometers shall be of the solid-stem, mercury-in-glass type.

5 TEMPERATURE SCALE

5.1 The thermometers shall be graduated in degrees Celsius (°C). The thermometers shall have range from 35·0 to 42·0°C or 35·0 to 43·0°C.

6 CALIBRATION

6.1 The thermometers shall be calibrated for total vertical immersion.

7 REQUIREMENTS

7.1 Patterns

The stem of thermometers shall be as shown in Fig. 1. There shall be two patterns of bulb, namely, 'oral' and 'rectal' as follows:

a) Oral — for thermometers for use in mouth, and

b) Rectal — for thermometers for use in rectum.

NOTES

1 Oral thermometers may also be used in armpit or groin.

2 Rectal thermometers may also be used in the mouth, armpit or groin, after proper disinfection. Rectal thermometers, if used orally, may however, give slightly lower reading.

7.2 Materials

7.2.1 *Glass Tubing*

The thermometers shall be made from glass tubing conforming to IS 4529 : 1968.

7.2.2 *Bulb*

The thermometer bulb shall be made from a type of glass which assures that the depression of zero, determined in accordance with the procedure given in Annex D, does not exceed 0·07 °C. The glass shall be identified visibly and indelibly, either by the glass manufacturer or by the manufacturer of the thermometer [*see* **9.1** (f)].

7.2.3 The types of glass used for the maximum device, capillary tube, and bulb shall meet the following requirements:

When the glass is analyzed according to the requirements of IS 2303 (Part 1/Sec 1), the quantity of alkali passed into solution for 1 g of glass must correspond to no more than 263·5 g of Na_2O.

7.2.4 *Thermometric Liquid*

The thermometric liquid shall be pure, dry mercury.

7.3 Construction

7.3.1 *Stem*

The stem shall be in alignment with the bulb.

7.3.1.1 The free end of the stem shall be finished smooth, preferably hemispherical in shape, as shown in Fig 1.

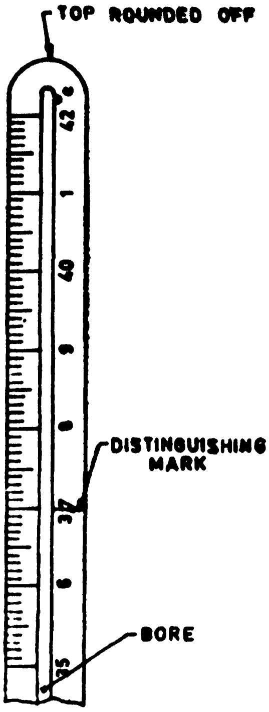


FIG. 1 STEM OF CLINICAL THERMOMETER

7.3.2 *Maximum Indicating Device (Constriction)*

The thermometers shall have a maximum indicating device, in the capillary, in order to prevent the mercury in the stem from returning to the bulb on cooling. It shall be located in the bore between the top of the bulb and the bottom of the scale.

7.3.2.1 The maximum indicating device shall pass the hardness test prescribed in Annex A, when an acceleration of 600 m/s^2 is applied at the closed end of the bulb for a period of at least 2 minutes.

7.3.3 *Locator*

A locator may be drawn on the stem before the start of the scale to facilitate positioning the thermometer so that the mercury column is in full view. The locator may comprise a thick (1 mm or more) dot or line or a rectangle of 1 × 3 mm.

7.3.4 *Bulb*

The bulb shall be cylindrical with a smoothly rounded end and shall be in alignment with the stem (*see* Fig. 2).

7.3.4.1 The diameter or bulb and the joint of bulb with stem, shall nowhere exceed that of the stem. The joint shall be smooth and regular.

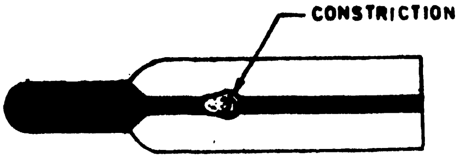


FIG. 2 SHAPE OF BULB FOR CLINICAL THERMOMETER

7.3.4.2 The bulb shall be hemispherical at the tip.

7.3.5 The bulb, capillary tube and mercury shall be sufficiently free from entrapped gas, debris and foreign bodies in order to ensure the correct functioning of the thermometer.

7.4 Dimensions

The dimensional and scale requirements for clinical thermometers shall be as given in Table 1.

Table 1 Dimensional and Scale Requirements for Solid-Stem Clinical Thermometers

Sl No.	Particulars	Requirements
i)	Scale range, °C	35·0 to 42·0 or 35·0 to 43·0
ii)	Smallest scale division, °C	0·1
iii)	Overall length, mm	100 to 115
iv)	Scale length, mm	40 to 65
v)	External diameter of stem, mm	4 to 6
vi)	Bulb length, mm (*see* Note)	
	a) Oral thermometer	12 to 18
	b) Rectal thermometer	Not more than 9
vii)	External diameter of bulb, mm	
	a) Oral thermometer	2·0 to 3·5
	b) Rectal thermometer	3·0 to 6·0 (but not exceeding that of stem)
viii)	Distance from top of the constriction to the 35·5°C mark, *Min*	10
ix)	Distance from the highest graduation line to top of the stem, mm, *Min*	8
x)	Scale spacing, mm, *Min*	0·5

NOTE — *See* Fig. 3 of IS 8787 : 1977.

7.5 Graduation and Numbering

7.5.1 The thermometer scale shall be sub-divided in 0·1°C as shown in Fig. 1.

7.5.2 The graduation lines shall be equally spaced and shall be at right angles to the axis of the thermometer.

7.5.3 All graduation lines shall be equal and of uniform thickness of not more than 1/4 of the length of the smallest scale division or 0·15 mm, whichever is less.

7.5.4 The pattern of graduation and numbering shall be as follows:

a) every tenth graduation lines shall be a long line (about 2 mm) which shall be numbered,

b) There shall be a medium line (about 1·5 mm) midway between two consecutive long lines, and

c) There shall be four short lines (about 1 mm) equally spaced between consecutive medium and long lines.

7.5.5 When the thermometer is held in a vertical position and viewed from the front, the left-hand ends of all the graduation lines shall lie on an imaginary vertical line (*see* Fig. 1).

7.5.6 The numbers shall be placed to the right of the axis in such a way that extension of the line to which they refer, would bisect them. The numbers shall be placed parallel to the axis of the thermometer.

7.5.7 A distinguishing mark (say, an arrow or a dot) shall be marked/etched at 37·0°C to prominently indicate the 'normal temperature'.

7.5.8 All graduation lines and numbering shall be clearly and permanently marked or etched on the stem and filled with a pigment. The marking shall pass the test for permanency given in Annex B.

NOTE — The pigment may be black, red, green or blue as agreed to between the purchaser and the supplier.

8 PERFORMANCE REQUIREMENTS

8.1 Appearance

When heated to 42°C or so, the mercury column shall look like a rectangular strip of uniform width, clarity and brightness throughout.

NOTE — The test takes care of all visual defects, for example, twist in the glass, aberrations, cloudiness devitrification, etc.

8.2 Ageing and Accuracy

8.2.1 The clinical thermometers shall meet all the requirements after ageing by natural or artificial means.

Natural ageing involves holding the thermometers at room temperature for four months after completion of the construction. Artificial ageing method involves heat treatment of the bulb and constriction of the unfilled thermometer at a temperature and duration to be specified by the manufacturer of the glass tubing.

8.2.2 Clinical thermometers after ageing as per **8.2.1** shall ensure that their accuracy as measured by the method specified in Annex C, shall be $^{+0·1}_{-0·15}$°C for at least one year after the first official verification.

8.3 Influence of Immersion Time

If a thermometer at temperature t_1 (15 °C $< t_1 <$ 30°C) is suddenly immersed in a well-stirred water bath having a constant temperature t_2 (35·5°C $< t_2 <$ 42°C) and is withdrawn after 20 seconds, the thermometer reading, after cooling to ambient temperature (15°C to 30°C),

a) shall comply with maximum permissible error requirement (*see* **8.2.2**), and

b) shall not deviate from its stabilized reading for temperature t_2 by more than 0·005 ($t_2 - t_1$).

This stabilized reading is the thermometer reading obtained when the thermometer has been cooled to ambient temperature, after reaching complete thermal equilibrium with the water bath at temperature t_2. This reading shall also meet the maximum permissible error requirements stipulated in **8.2.2**.

NOTE — A free choice of test method is permitted, provided the law of the variation of the indication of the thermometer as a function of immersion time is known.

9 MARKING AND PACKING

9.1 Marking

Each clinical thermometer shall be legibly and indelibly marked on its stem with the following:

a) The letter °C near the top of the scale,

b) The word 'oral' or 'rectal' as the case may be,

c) An indication of the source of manufacture,

d) A code number to trace the batch of manufacture,

e) A recognized mark of the verifying authority showing the year of initial verification, and

f) An indication identifying the glass used for the bulb, if the glass is not already identified by its maker.

9.1.1 Each clinical thermometer may also be marked with the Standard Mark:

NOTE — The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9.2 Packing

9.2.1 Clinical thermometers shall be securely packed individually or collectively, in any manner acceptable to the purchaser, so as to minimize the risk of damage in handling, transport and storage.

9.2.2 A pamphlet with instructions for proper use shall be provided by the manufacturer with each thermometer.

10 SAMPLING

10.1 Lot

All thermometers of the same type, in a single consignment and produced under similar conditions of manufacture shall constitute a lot.

10.2 For permanency of marking, the number of thermometers to be tested shall depend on the size of the lot and shall be in accordance with Table 2. All the thermometers so tested shall satisfy the test as specified.

10.3 For remaining characteristics given in the specification, all thermometers in the lot shall be tested and shall conform to each of the corresponding requirements.

Table 2 Scale of Sampling

(*Clause* 10.2)

Number of Thermometers in the Lot	Sample Size
N	*n*
Up to 500	5
501 to 1 000	8
1 001 to 3 000	13
3 001 to 10 000	20
10 001 and above	32

ANNEX A

(*Clause* 7.3.2.1)

TEST FOR HARDNESS OF MAXIMUM INDICATING DEVICE

A-1 APPARATUS

A-1.1 Centrifuge

A centrifuge with radial arms 15 cm each. Each arm shall be provided with a pocket for keeping one or more clinical thermometers. Speed of the centrifuge shall be either fixed or adjustable to 600 rpm.

NOTE — In general, centrifugal acceleration is $4\pi^{-2} r/N^2$; which reduces to $r N^2 = 5\,472\,000$, if r is in cm, N is revolutions per minute and the required acceleration is 600 m/s², as specified in 7.3.2.1.

A-2 PROCEDURE

A-2.1 Place the thermometers for some time in water at a temperature anywhere between 42 and 43°C.

A-2.2 Then put them in the pockets of the centrifuge, bulbs facing outwards, that is, away from the axis of the centrifuge while in rotation.

A-2.3 Let the centrifuge work steadily at its correct speed for at least 2 minutes. Then stop it.

A-2.4 Take the thermometers out of the pockets and observe the mercury column.

A-2.5 Thermometers shall be taken as having satisfied the requirement of this test if the mercury column rests below or at 35°C mark.

IMPORTANT — It is necessary that the room temperature does not exceed 34·5°C during the test.

ANNEX B

(*Clause* 7.5.8)

TEST FOR PERMANENCY OF MARKING

B-1 PROCEDURE

B-1.1 Place the thermometers in a 5 percent (*m*/*v*) solution of phenol in water maintained at 37 ± 0·5°C for a period of 20 minutes.

B-1.2 Wipe the thermometers dry with a piece of soft cloth and examine.

B-1.3 The thermometers shall be considered to have passed the test if, after this treatment, the marking does not peel off anywhere.

ANNEX C

(*Clause* 8.2.2)

TEST FOR ACCURACY

C-1 APPARATUS

C-1.1 Comparator Bath

Either screw type or bubbler type, as prescribed in IS 6274 : 1971, filled with water.

C-1.2 Reference Thermometers

Calibrated reference thermometers (*see* Schedule Mark 15 Tl of IS 4825 : 1968).

C-2 PROCEDURE

C-2.1 After preliminary check of the clinical thermometers, carry out the accuracy test in accordance with **6.2** of IS 6274 : 1971 at 37·0 ± 0·5°C, 39·0 ± 0·5°C and 41·0 ± 0·5°C respectively.

C-2.2 The thermometers shall be considered to have passed this test if the accuracy so determined lies within limits prescribed in **8.2**.

ANNEX D

(*Clause* 7.2.2)

DETERMINATION OF THE MEAN DEPRESSION OF ZERO OF THERMOMETERS

D-1 It is not possible to determine the depression of zero of clinical thermometers (mercury-in-glass, with the maximum indicating device) covered by this specification. Therefore, special test thermometers (**D-2**) shall be manufactured from the glass being examined in order to conduct the necessary measurements.

D-2 The test thermometers must meet the following requirements.

D-2.1 Scale Range

At least from −3·0°C to +3·0°C.

D-2.2 Scale Interval

0·02°C, 0·05°C or 0·1°C.

D-2.3 The scale spacing must be at least 1·0 mm.

D-2.4 The expansion chamber must be large enough to allow the thermometers to be heated to 400°C without damage.

D-2.5 The thermometers must be properly stabilized by the manufacturer and must meet the requirements of the stabilization test (*see* **D-3**).

D-3 The proper stabilization of each test thermometer must be tested in accordance with the following provisions.

D-3.1 The thermometer is heated in a test bath (liquid bath or metal block type oven) from ambient temperature up to 350°C ± 10°C and kept at this temperature for at least five minutes. It is then cooled to 50°C in the test bath, which decreases in temperature by 10 to 15°C/h.

D-3.2 When the thermometer has reached a temperature of 50°C, it is removed from the test bath and its 0°C correction value (K_1) is determined with the help of a zero point (0°C) ice bath, which consists of a Dewar flask filled with finely crushed ice covered over with water. The water used to make the ice and the water in which ice is submerged must be pure. Its electrical conductivity must not exceed 10^{-3} $S.m^{-1}$ at 20°C. The ice must be carefully tamped so that there are no air bubbles in the ice-water mixture. It must be compacted as much as possible both prior to measurement and periodically during measurement.

It is recommended that a water purifier, a refrigerator with ice trays and an ice crusher be employed for preparing the ice-water mixture.

D-3.3 The thermometer is then heated a second time to 350°C ± 10°C in the test bath and kept at this temperature for 24 hours. It is then cooled to 50°C, as before (**D-3.1**).

D-3.4 When the thermometer has reached a temperature of 50°C, it is removed from the test bath and its 0°C correction value (K_2) is determined once more.

D-3.5 K_2 must not differ from K_1 by more than 0·15°C. Thermometers which do not meet this requirement must not be used to determine the depression of zero.

D-4 The mean depression of zero is determined in accordance with the following provisions.

D-4.1 At least three test thermometers must be used. They must be manufactured from the glass being tested, must have met the requirements of the stabilization test (**D-3**), and not have been heated above the ambient temperature once value K_2 has been determined (**D-3.4**).

D-4.2 Each of these thermometers must be tested at least three times in accordance with the provisions of **D-4.2.1**, **D-4.2.2** and **D-4.2.3** below.

D-4.2.1 The thermometer is kept in a test bath at 100°C ± 1·0°C for 30 minutes. It is then removed from the bath and allowed to cool in air. While it is cooling to ambient temperature, its bulb must not come into contact with other objects.

D-4.2.2 The 0°C correction of the thermometer is determined not later than 15 minutes after the thermometer has been removed from the test bath. The correction value obtained is designated by the symbol K_3.

D-4.2.3 The thermometer is then kept for one week at a temperature between 20°C and 25°C. At the end of the week the 0°C correction is determined. This correction value is designated K_4. The procedures described in **D-4.2.1** and **D-4.2.2** are then repeated, and a 0°C correction value, designated K_5, is obtained.

D-4.2.4 The procedures described in **D-4.2.3** are repeated to obtain a series of *n* differences $K_2 - K_3$, $K_4 - K_5$, $K_{2n} - K_{2n+1}$. These are the values of the thermometer's depression of zero from the first, second and *n*th series of measurements, respectively.

D-4.2.5 When *n* series of measurements have been made with *m* test thermometers, the following expression is obtained for the mean depression of zero of these thermometers:

$$\frac{1}{mn}\sum_{i=1}^{m}\left[\left(\overset{(i)}{K_2}-\overset{(i)}{K_3}\right)+\left(\overset{(i)}{K_4}-\overset{(i)}{K_5}\right)+\dots\dots\dots + \left(\overset{(i)}{K_{2n}}-\overset{(i)}{K_{2n+1}}\right)\right]$$

which must not exceed 0·07°C (*see* **7.2.2**).

In accordance with the provisions of **D-4.1** and **D-4.2**, the conditions

$$m > 3 \text{ and } n > 3$$

must be met for *m* and *n*, and the standard deviation of the mean depression of zero determined in accordance with the aforementioned provisions, must not exceed ±0·01°C.

D-4.2.6 If a more accurate value for the mean depression of zero is required, at least five series of measurements on at least five test thermometers must be carried out.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publication), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

This Indian Standard has been developed from Doc: No. **MHD 12 (2589)**

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:		Telephone
Central	Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	323 76 17, 323 38 41
Eastern	1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola CALCUTTA 700054	337 84 99, 337 85 61 337 86 26, 337 91 20
Northern	SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43 60 20 25
Southern	C.I.T. Campus, IV Cross Road, CHENNAI 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western	Manakalaya, E9 MIDC, M [illegible], Andheri (East) MUMBAI 400 [illegible]	832 92 95, 832 78 58 832 78 91, 832 78 92

Branches : AHMADA [illegible] LORE. BHOPAL. BHUBANESHWAR.
COIMBA [illegible] DABAD. GHAZIABAD. GUWAHATI.
HYDERA [illegible] PUR. KANPUR. LUCKNOW. NAGPUR.
PATNA. [illegible] THIRUVANANTHAPURAM.

Printed by Reprography Unit, BIS, New Delhi